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**Folks and fields need lime.**



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# FOLKS<sup>AND</sup> FIELDS NEED LIME



INTERNATIONAL HARVESTER COMPANY  
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HARVESTER BLDG. CHICAGO



*Soils and Fields  
need Lime  
Ralph A. Stayer*

**H**ALF the soils of the United States need lime.  
When soils need lime they are said to be "sour."

*Sour soils are not worth much until they are limed.*

*We can supply lime to our soils by spreading limestone, lime, shells or marl upon them.*

*We should use the form of lime which, under our conditions, does the most good for the money.*

*Our County Agents, Agricultural Colleges and Experiment Stations know local conditions and will help us decide on the kind and amount of lime to use.*

*This booklet is not to discuss the technicalities or chemistry of lime.*

*It is to encourage us to use lime or limestone on our farms when it is needed.*

*The word "lime" as used in this booklet, unless definitely designated, is a general term including any kind of agricultural lime or limestone.*

# FOLKS and FIELDS NEED

## L I M E

*By* RALPH A. HAYNE  
OF THE AGRICULTURAL EXTENSION DEPARTMENT

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P. G. HOLDEN   FIELD DIRECTOR  
HARVESTER BLDG. CHICAGO

## A LIMESTONE COUNTRY IS A RICH COUNTRY

Wherever we find an abundance of lime in the soil and plenty of moisture, there we should find the strongest people, the best live stock, the best pastures, the biggest crops, the most prosperous farmers, the best towns.



We don't find this sort of a farm with a soil scarce of lime. If lime wasn't already in this soil, somebody put it in before this scene happened. There isn't anything in the soil shown in this picture but what can be put in any soil.



The main difference between these two fields is that the one on the right, with its rank, rich clover and soil full of roots has lime in the soil, while the one on the left with its cold, bare, lifeless clay is scarce of lime. It's lime that made that clover grow. Is the difference worth liming for?

A soil naturally filled with lime is a great blessing but remember, we can put lime in any soil and make a blessing of it.

## **A Sour-soil Country is a Poor Country**

When soils need lime, the crops get small and of poor quality, farmers get poor and discontented, towns get shabby and desolate.



**Tumble-down, abandoned buildings, little shaggy animals, little scraggly crops and stoop-shouldered despondent folks are found where the soil needs lime.**



**There are millions and millions of tons of limestone waiting to be spread on our soils, waiting to change our sour, money-losing farms to productive clover-growing fields.**

This matter of liming our soils is one which affects every one of us, man, woman and child, no matter whether we live in the country or the town.

It affects every farmer, banker, merchant, minister, teacher. It affects every home maker, wife, mother, business woman. It affects every citizen from 1 day to 90 years of age.

If we think we are not interested, let's finish reading this book; we may change our minds.

## Half the Soils of the United States Need Lime



Practically all the soils east of this line need lime. This means that clover and alfalfa don't grow on a lot of the farms east of the line. It means that none of the grasses or farm crops does its best on millions of acres on the east side of the line. It means that many people and many animals east of the line are weak because they don't get enough lime to make strong bones and teeth. It also means that we might work 14 hours a day, 313 days a year farming that soil and barely make a living; maybe get poorer each year.

There are also big patches west of that line that need lime. They are not so large, not so numerous and sometimes not so needy of lime as the east side but they are growing larger, sourer, and more harmful every year.

The cure for these lime-poor soils whether east, west, north or south is lime.

### *The Importance of Lime*

One of the first things that we need on most of our soils east of the Mississippi river is lime. We also need lime on the soil in many places west of the Mississippi river.

The foundation principle of successful farming and national prosperity is a maximum yield from every acre cultivated.

Important as is an efficient marketing system, we must not overlook the fact that maximum crops per acre are just as important.

Maximum crops are not possible when the soil needs lime.

We need more lime production and better and cheaper delivery to our farms.

The kind of lime we use depends on which kind is most economical in our case. If we must haul it long distances and pay freight on a long haul, let's use burnt lime. If we can get ground limestone handy and cheaply, let's use it. The main thing is to get lime on our soils that need it.

Use the lime to grow crops of clover and alfalfa, the crops that make our soils richer and furnish us the best live stock feed.

—P. G. Holden.

**Lime in the soil will not take the place of drainage or manure or fertilizer; lime will not take the place of good tillage. But drainage, manure, fertilizer or good tillage will not bring full returns without lime in the soil.**

## Why Do We Need Lime in Our Soils?

**First: Folks must have lime.** (See page 8).



The way for folks to get lime is in their food. Food comes from the soil; it grows out of the soil in the form of plants. The way to put lime in food is to have lime in the soil so plants can get it.

**Second: Animals must have lime.** (See page 9.)



Without domesticated animals people never amount to much. Animals never amount to much without plenty of lime in their food. Animals eat plants. The way to put lime in the animals' food is to have lime in the soil so plants can get it.

**Third: Plants must have lime.** (See pages 10 and 11.)



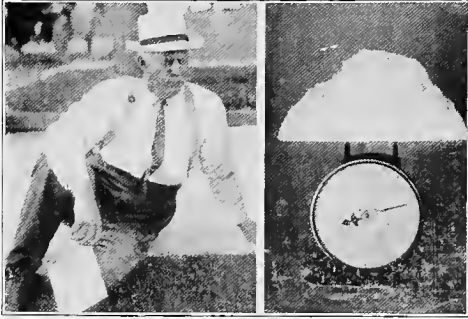
Our useful plants, the ones that make the best food, the ones that make the soil fertile, must have lime to help build their stems and leaves and seed. None of these plants does its best and some of them will not grow at all in soils that need lime. Without these plants we can't have good live stock or rich soil; without good live stock and rich soil we would be a poor people.

**Fourth: The soil itself must have lime.** (See page 12.)

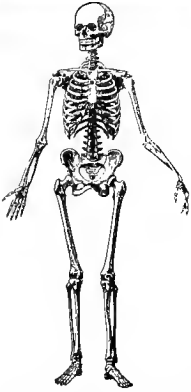


We want the soil to produce useful plants. Lime not only supplies food that plants must have, but it takes away harmful acids that keep plants from growing, makes the soil easier to cultivate, makes other plant food in the soil available so plants can use it, makes the soil a good place for bacteria, without which the soil is no good.

## Folks Must Have Lime



A man should have three pounds or more of lime in his body. Women and children should have nearly as much. The most of this lime is in the bones and teeth. We can't have much of a man or woman without a strong frame and good grinders.



We can't have strong bones and good teeth without plenty of lime in our food. Every boy and girl needs lime-rich food every day.

Many a youngster has weak bones, rickets, bow legs, struggles along only to be a frail, unhappy man or woman to die young because of lack of lime in the food.

Don't shy at this picture; each of us has a skeleton, and if it isn't a strong, lime-fed skeleton it will go to the grave before its time.



Teeth like these for our boys and girls are worth more than anything we can leave them in our wills.

Folks grown in lime-rich countries have stronger frames, better teeth, better muscles and longer life than folks in countries where there is but little lime.



We get lime from vegetables; we get it from milk.

The way to put lime in vegetables, the way to put lime in the cow feed so the cow can put lime in the milk, is for us to put lime in the soil, if it is not already there.

## Animals Must Have Lime

Our best breeds and families of live stock have been developed in countries where there is lime in the soil. Animals must have lime for bones and teeth just as much as folks.

No kind of live stock will grow strong and vigorous without bone and muscle-making feeds like clovers and alfalfa, and clovers and alfalfa do not thrive on soils that need lime.



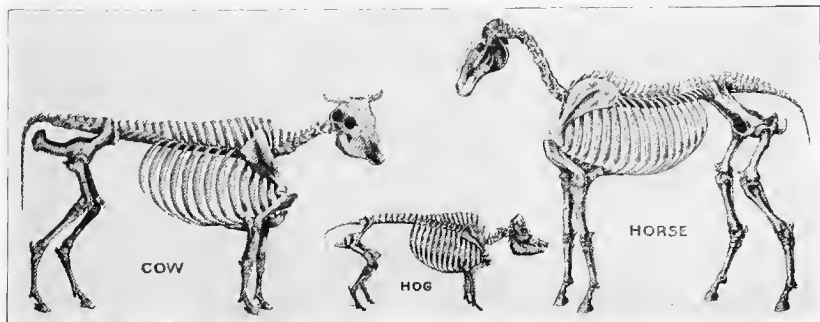
These calves have lived on blue grass, white clover, alfalfa and red clover, grown on a lime-rich soil.



These calves have tried to live on scanty pasture grown on an impoverished and lime-poor soil.



Animals fed on crops grown on soil that needs lime are apt to be undersized, rough-haired, unthrifty. Keep the same family of animals eating crops on a lime-poor soil and each generation will be smaller and weaker than the one before.



It takes lime and lots of it to make these frames strong. No animal is worth having with a framework of weak bones.

## Plants Must Have Lime

Because it's through plants that people and animals get lime.

There is lime in all plants.

The more useful the plant as a food and as a soil enricher, the greater the amount of lime it contains and the more lime we should have in the soil for it. (See next page.)

**The more lime there is in the soil, the more there will be in the plants.**



This tall, leafy alfalfa growing out of this lime soil has more lime in it than—

this scattering, puny alfalfa, trying to live in a soil that is scarce of lime.



Oats like these, grown where the soil is rich and full of lime, have more lime in them than—

oats like these, grown in soil that is scarce in all kinds of plant food including lime.

The alfalfa and oats growing on the lime soil not only produce more to the acre but every pound is better feed, and when eaten will make more bone and muscle than that grown on sour soil.

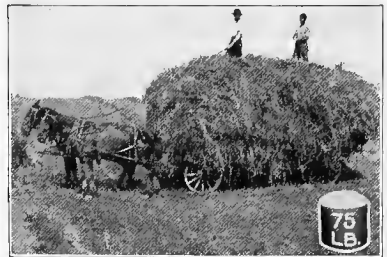
**Let's not forget that lime doesn't take the place of other plant food in the soil—but it does help the plant to get the other food.**

## Plants Must Have Lime

How can we expect plants to get a full supply of lime if there is not plenty of lime in the soil?



In a ton of alfalfa hay there are about 100 pounds of lime.



In a ton of red clover hay there are about 75 pounds of lime.



In an acre of good corn there are about 25 pounds of lime.



In an acre of good oats there are about 20 pounds of lime.

The more lime there is in the soil, the more there will be in the plants and the better feed the plants will make.

Notice the great quantities of lime in alfalfa and clover. This helps to explain why alfalfa and clover sometimes fail when other crops grow fairly well.

### ***Attention, Every Farmer Where the Ground Freezes:***

Plenty of lime in the soil will help to keep plants from heaving and winter killing. No, plenty of lime in the soil won't take the place of drainage but on well drained soil clover and alfalfa and other plants will grow strong and have strong roots, if they have plenty of lime, and strong vigorous plants will stand a lot more freezing and thawing than weak plants will.

## **The Soil Must Have Lime**

Because:

First: It's from the soil that plants get their lime.

Second: Soils get acids and "poisons" in them that keep good plants from growing. That's what we call "sour soil."

Lime neutralizes or kills these acids or poisons. This action of lime is called "sweetening the soil."



This old field has been farmed and cropped until the soil has acids and "poisons" in it so plants can't get enough lime and won't half grow. A man might work and worry and "whet" away on that old field for 20 years and never get a good crop. This field needs a dose of lime to sweeten it up; then it will respond to manure and fertilizer and cultivation and it will grow legume crops without which farming and live stock feeding are failures.



When we see a field growing a half crop or less than a half crop like this we know the soil needs lime and that the man who is farming it isn't very prosperous.

**We can't get much profit from a field unless we get big crops from it. Lime may be the main thing on which big crops depend.**

## ***All Soils Have Some Lime in Them***

Even "sour" soils have some lime but they haven't enough. (Read pages 23 and 24.)



Even the soil in this old, sour field has lime in it but the trouble is the lime is so scarce and so hard for the plants to get that we can't grow a big crop unless we put on some lime.

There are a few plants with such strong feeding roots that they can get enough lime to make a fair crop even when there isn't much lime in the soil, providing there is enough other plant food for them, but these plants grow better when there is plenty of lime.



Corn and oats are examples of plants that can grow pretty well when there isn't much lime in the soil but they always grow better when lime is plenty.

Even if there is some lime in all soils and even if some plants will grow in sour soil; the soil may need more lime anyway, because we must grow different crops in our rotations and the best crops in our rotations need lots of lime.

The safe way is to have plenty of lime in the soil ready for any of the crops, then all the crops will grow better.

## Lime Makes Bigger Crops

An application of lime will not only make valuable crops like clover and alfalfa grow where they wouldn't grow before, but it will often nearly double the yield of other crops that will grow on sour soil.



Here's what lime will do.

Sweet clover and alfalfa growing together in Dutchess County, New York. County Agent F. H. Lacey says: "Before this field was limed it grew nothing but goldenrod and daisies." Sweet clover and alfalfa must have lime.



The difference between lime and no lime. Indiana Experiment Station.

Look at that big, healthy alfalfa in the background where ground limestone was spread, and no alfalfa in the foreground where no lime was spread.



No lime

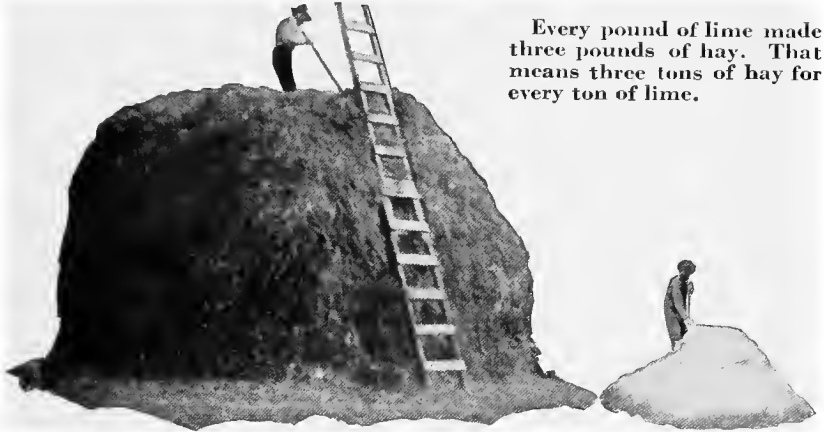


Lime

The Alabama Experiment Station reports 41 per cent increase in the yield of corn from the use of lime. Corn is not always benefited by lime as much as some other crops, yet on an acid soil lime sure makes a difference.

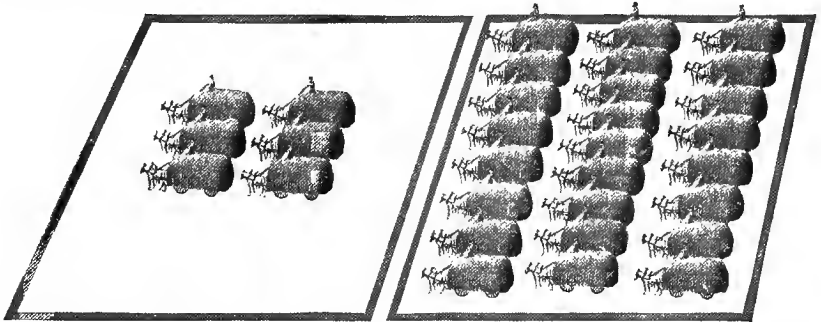
No matter how much tillage we provide or how much manure and fertilizer we use, we can't expect full returns if the soil needs lime. Read the next page.

## Lime Makes Bigger Crops



Every pound of lime made three pounds of hay. That means three tons of hay for every ton of lime.

Ralph O. Smith of the New York Extension Service, while county agent of Alleghany County, New York, reported that trials in that county resulted in an increase in yield of three pounds of hay for every pound of lime spread. How much will a ton of lime cost us? How much are three tons of hay worth? Let's figure it for ourselves.



Before liming; only six loads of hay on eight acres.

After liming; 25 big loads on the same eight acres.

This happened on the farm of A. H. Clark, Harvester Company blockman in Albany, New York, territory. He says: "Lime on our eastern farms will more than double crop production."



The Alabama Experiment Station says lime used in numerous experiments on sour soils increased cotton yields 2 to 129 per cent.

## Lime Makes Manure Worth More

Manure is one of the best fertilizers, but manure won't bring full returns until the soil has lime. **Don't mix lime with manure; put them on separately.**



Manure only; 35.6 bushels of corn per acre.

Manure and limestone; 49.3 bushels of corn per acre.



Manure only; 3,740 pounds of hay per acre.



Manure and limestone; 6,170 pounds of hay per acre.

These pictures show the increase in crops from using ground limestone with manure by the Indiana Experiment Station. The manure was put on at the rate of six tons to the acre once in three years and the limestone was put on at the rate of two tons per acre. The extra yields the first year more than paid for the limestone, to say nothing of the extra yields that followed in later years.



Millions of dollars worth of fertility has been wasted by leaving manure to leach and rot out back of the barn.

A big share of the manure that has been spread on our fields has not done its best because we spread it on soil too sour to grow big crops even when it was manured.

## Lime Makes Fertilizer Worth More

Commercial fertilizers are profitable when rightly used. But we can't expect to get full profit from any fertilizer unless there is plenty of lime in the soil.

Look at the results shown below from using fertilizer alone and fertilizer with ground limestone on black, sandy acid soils by the Indiana Experiment Station.

In this test, covering a three-year rotation, 400 pounds to the acre of 2-10-8 fertilizer were used on one plot and on the other plot the same amount of fertilizer was used and in addition four tons of ground limestone to the acre. Note the increase in yields where the limestone was used.

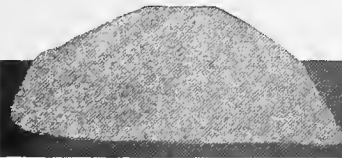


**Fertilizer only, 21½ bushels per acre.**



**Fertilizer and limestone; 32½ bushels.**

Corn



**Fertilizer only, 22 bushels per acre.**



**Fertilizer and limestone; 35 bushels**

Oats



**Fertilizer, 1,000 pounds per acre**



**Fertilizer and limestone; 3,900 pounds**

Hay

Every year thousands of tons of commercial fertilizer fail to bring full returns because the fertilizer is used on fields that are too sour for any kind of fertilizer to do its best.

What millions of acres need is lime; then fertilizer has a full chance to make a profit.

## ***Lime Helps to Get Plant Food From the Air***

Three-fourths of the air is nitrogen.

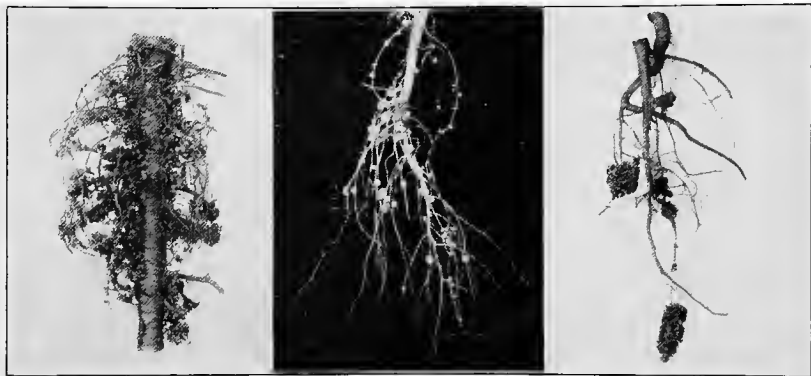
Nitrogen is one of the best plant foods, and one of the most expensive when we have to buy it.

We can get nitrogen by using bacteria that live in nodules on the roots of plants.

These bacteria, which make plant food out of nitrogen from the air, get sickly, won't gather much nitrogen and may die in soil that needs lime.

Put plenty of lime in the soil and these bacteria will live and multiply and work, then the plants will grow big and strong, and the soil will get rich.

Here are some of the plants which have nodules on their roots when the soil is sweet. **When the soil needs lime there won't be many nodules and there won't be much nitrogen gathered.**



**Sweet clover, good for pasture, hay, makes soil rich.**

**Soy beans, useful on many farms that have never grown them.**

**Alfalfa lives longest and makes the most and richest feed.**

The more lime there is in the soil, the more nodules there will be on the roots.

Plants with nodules on their roots are the ones that not only make the soil rich, but they are the ones that furnish the best bone and muscle making foods, and they are the ones that have the most lime in them. (See page 11.)

Some of these plants will grow all right in a rich soil even when lime is scarce, but having no nodules they are getting their nitrogen out of the soil, making the soil poorer, when they ought to be getting their nitrogen out of the air. **Give them lime and they will get nitrogen from the air.**

## ***There Are Other Bacteria in the Soil that Need Lime***

They help to make plant food by working right in the soil without being attached to plant roots.

These bacteria need lime as much as the ones on the roots of alfalfa and clover and beans.

We don't know what all these bacteria do but they help plants to grow; some of them make humus out of roots and stubble and manure, and work them into plant food.

**When we spread a load of  
manure—**



**Or when we plow under a  
sod or stubble or a heavy  
growth of clover, rye or  
weeds; whenever we put  
vegetable matter on or in  
the soil, it is bacteria that  
works it into plant food.**



These bacteria won't work full time or full strength and maybe won't work at all in a soil that needs lime.

Without bacteria the soil would be dead, would cease to produce and that would mean starvation for folks.

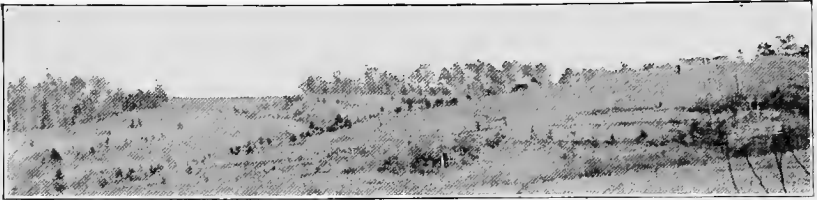
**Give the soil lime and we make it a good place for bacteria to work; then we get the full use of the manure and fertilizer and other plant food in the soil, then we can grow the right kind of plants.**

## Lime Makes Good Pastures

Good pasture furnishes the best feed for live stock. Animals like good pasture, they thrive on it, they feed themselves. There has never been a better way found to keep live stock through the summer than to turn them on pasture.



Good pasture means regular grass where the animals can get a mouthful without biting into the ground and pulling out part of the grass roots.



There are millions of acres of rough and hilly land fit only for pasture. There are other millions of acres under cultivation which if converted into good pasture, would make us better off.

Pastures need lime just as much as cultivated crops do. We need legumes in the pasture to help keep the soil rich and to furnish bone and muscle feed, just as much as we need legumes in our crop rotations. We can't have good legumes in either pastures or cultivated fields without lime.



There are millions of acres of so-called pastures, tramped out, chewed out, starved out, producing a few scraggly, weak plants, feeding a few hungry, undersized animals. These pastures with proper care, reseeding, fertilizing, and liming could without great outlay of cash be made into profitable fields.

## **Lime Makes Good Pastures**

Our greatest pastures, the ones on which our best breeds of animals have developed, the ones that furnish a complete ration for live stock, the ones that grow and fatten animals without an addition of grain feed, are pastures growing out of lime-rich soil.

The blue grass pastures of Kentucky are famed the world over for the quality of their horses, cattle, hogs, and sheep. These pastures grow out of a soil naturally filled with lime.



**A Kentucky pasture**

The pastures of Virginia and West Virginia that every year turn off prime, finished, fat steers that have eaten nothing but grass, also grow from soils full of lime.



**Steers in Virginia blue grass**

Wisconsin's, Illinois' and Iowa's famous Mineral Point limestone pastures have for 50 years fattened cattle without grain.



**Fattening on Mineral Point  
blue grass**

Great pastures grow only on lime-filled soils.

These famous pasture lands are valued at a high price per acre, yet the owners think too much of them to plow them up.

Some of us have a mistaken notion about land being too high priced for pasture. We need to cultivate fewer acres, and make some of our high priced land into real pastures instead of the sorry imitations that we have.

We need to make our cheap, hilly lands into good pastures, then they won't be cheap. Just as much grass can be grown on a slope as on the level.

We can make any pasture good by giving it lime, plant food and proper care.

## The Garden Needs Lime

A good garden is worth five times as much per acre as any other cultivated spot on the farm.

The garden should furnish us with a big part of our food, both summer and winter.

Food from the garden is healthful and nourishing, furnishing us lime and minerals which we must have, furnishing us roughage which we must have, and furnishing us all the laxatives and tonics that anybody needs.

Practically all garden plants grow best in a lime soil.



Cabbage, beans, cauliflower, peas, celery, parsnips, lettuce, onions, beets and nearly all garden crops need a lime soil.

The garden needs manure. Remember that manure will not bring full returns unless the soil has lime. (See page 16.)

Give the garden from 10 to 20 pounds of caustic or hydrate lime, or about twice that amount of finely ground limestone to the square rod.

Wood ashes are good for the garden because they contain lime and potash. (See page 37.)

## The Lawn Needs Lime



A well-kept lawn is the nicest thing that can be spread in front of and around any home. The best lawn grasses grow best where lime is in the soil. An application of lime on the lawn the same as on the garden may make the grass grow and improve the appearance of our place 100 per cent.

## The Orchard May Need Lime

Trees will grow on sour soil if it has a fair amount of other plant food in it, yet thousands of fruit trees have starved on sour soil.

Trees, to make a strong disease-resisting growth, must have fertile soil, and sour soils usually aren't fertile.



Thousands of fruit trees have starved to death.



These peach trees in the Southern Indiana orchard of County Agent C. A. Richards show the unusual vigor resulting from the use of ground limestone and nitrate of soda. Mr. Richards says: "Where limestone was applied the trees are far superior to those where no limestone was applied. We intend to lime every inch of soil before we plant fruit trees in the future."



When orchards aren't cultivated they should be mulched and as much mulch as possible should grow right in the orchard. An application of lime will help the orchard grow clover for mulch.

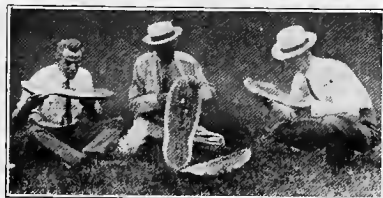


A dose of lime would make clover grow instead of these daisies and wild carrots, and clover mowed and spread thickly over the roots of a fruit tree will sure put life into it if it is not entirely dead.

## *Some Plants Grow Better than Others in Sour Soil*



Potatoes are sometimes said to grow better in sour soil. This opinion is based on the fact that lime in the soil encourages the growth of potato scab which damages the potatoes. Lime really makes the soil better for potatoes when there is no potato scab. *Better put lime on the soil after the potato crop rather than before it.*



Watermelons, blackberries and a few other plants grow well in soils that contain but little lime, providing the soil is otherwise fertile.

Several of these plants are sometimes listed as needing but little lime, but let's not forget that while these particular plants may need but little lime, the other plant food that they need and the condition of the soil that they must have may depend very much on lime. After all, lime is one important thing on which all useful plants depend either directly or indirectly.



Rye and timothy are examples of crops that make a fair growth on soils that do not contain much lime. This is not because these plants do not use lime, but because they have feeding systems that can gather enough lime even when it is scarce in the soil. *These plants grow better when there is plenty of lime in the soil.*



Lime is a weed fighter. Some weeds, such as horse sorrel, grow in sour soil. The main reason they grow so well in sour soil is because useful plants won't make enough growth to crowd them out. Put on lime so we can grow big crops of clovers and other useful plants and we will give the weeds a run for their lives.

## ***We Don't Get All the Returns from Lime the First Year***

When we apply lime to the soil we are laying a foundation for good living and profit for years to come.



**Lime helps us to get a big growth of clover or other legumes with bacteria on the roots, gathering nitrogen. This makes the soil rich, full of roots and humus.**



**When we plow the field after the legume crop we get a big yield of corn or cotton or some other cultivated crop because the soil has been made rich.**



**After the cultivated crop we get a big yield of oats or wheat in the rotation.**



**Then we have feed, and lots of it, for good live stock and, besides, have crops to sell.**

In addition, lime makes more and better grass grow in our pastures. The pasture grass lives longer, feeds more stock, stands the winter better, suffers less from tramping and starts earlier the next year.

Besides this, lime makes the garden better, furnishing better food for us, particularly the boys and girls, giving them health and vim for the years ahead.

When we get all these things with good markets, then it's our fault if we aren't prosperous and happy.

A long train of good things surely follows the use of lime.

## What Becomes of the Lime in our Soils?



Every heavy rain leaches lime out of the soil. The soil in any country, where there is considerable rainfall, is apt to get sour because of the leaching of lime through springs and drain tile and into streams and wells.



If there's lime in the soil, there's usually lime in the water coming from tile drains and springs.



The crust that forms in the tea-kettle is made of lime that leaches into the water.



In dry countries like this, where it rains only once in a long time and then very little, the soil is not apt to be sour.



**Every bushel and every forkful takes out lime.**

Any soil that is continuously cropped will in time grow deficient in lime, if lime is not supplied.

Your farm may not need lime badly now but it likely will some day if you don't supply some lime. Better be safe and put on lime before it gets so scarce that the crops show it.

It may be a long time before your soil needs lime, but wouldn't it be a good plan to try lime on a strip in each field to be sure whether or not it needs lime now?

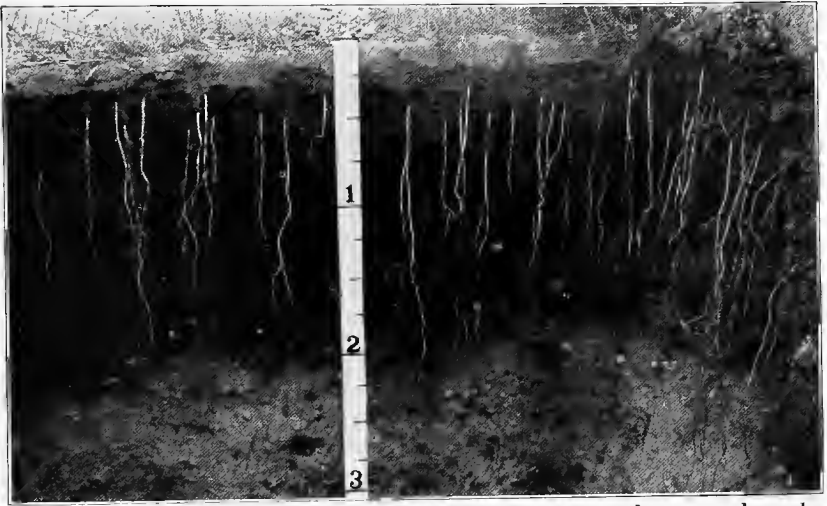
## **Lime Keeps Leaching Away**

Some soils, such as those made out of sandstone, probably never did have enough lime in them to grow big crops.



Some "new" soils that have never been farmed need lime when they are cleared or drained before they will grow good crops.

Some soils that were made out of limestone and with ledges of limestone under them now lack lime because of leaching and cropping.



Some soils have lime in the subsoil that helps the crop when the roots get down to it. This accounts for alfalfa's sometimes doing well when the roots get down into the subsoil. Some lime from the subsoil comes up by capillary action of water, but we can't depend much on that.

The sure and safe way when the surface soil needs lime is to put lime on, no matter what the soil was originally made of.

Life is too short to wait for crops to struggle down to the subsoil for lime. Better put lime on top and boost the crop along, then the roots will get to the lime subsoil sooner.

## How Can We Tell When the Soil Needs Lime?

The sure way to find out whether or not soil needs lime is to try lime on it.

We can usually tell when the soil needs lime by the kind of vegetation that grows on it. When clovers and other legumes don't grow well, and moss and red-colored weeds and grass do grow, it's pretty sure that lime is needed.



When we lime a strip in the field and find that it makes clover and other crops grow better, we have sure proof that the soil needs lime.

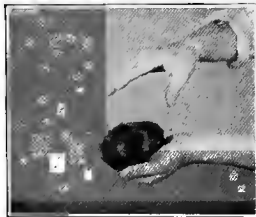
The litmus paper test is a good test to tell when the soil needs lime.



1. Get blue litmus paper at a drug store. Be sure to get **blue**.



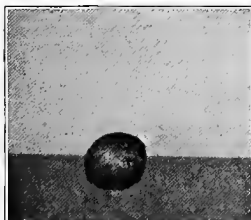
2. Wet a sample of soil with **soft** water. Don't use **hard** water.



3. Make a mud ball of the wet soil. Don't make it too wet.



4. Break ball open, lay in two strips of litmus, press ball together.



5. Leave the strips of paper in the ball for 15 or 20 minutes.



6. Open ball, look at strips. They will tell if the soil is sour.

If the strips of litmus paper turn pink or red the soil needs lime. The redder the paper turns the more lime is needed in the soil.

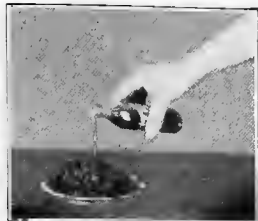
If the paper remains blue the soil is sweet or neutral. (See next page.)

**Caution.** Blue litmus paper turns red when it gets any acid on it, such as apple juice, or sweat from the fingers. Be careful that it touches only the soil.

## ***Muriatic Acid Will Show if There Is Lime in the Soil***

If there is much lime in the soil we can always tell by pouring a little muriatic acid on a sample of the soil.

We can get muriatic (called tinner's acid) at any drug store.



Pour a small quantity of muriatic acid on a sample of soil and watch for "bubbles." If the soil bubbles it shows that there is lime in the soil. The more the soil bubbles the more lime in it.



It is a good plan to first pour a little acid on some pure lime to see how it acts. Soil can have great quantities of lime in it and yet not bubble as much as pure lime when acid is poured on it.



With both litmus paper and muriatic acid we can tell whether the soil is sour or whether it has lime in it. First try the litmus paper, if the paper doesn't turn red, try the acid to find the lime.

The Truog test for soil acidity, much used by county agents, schools and others, was devised by Emil Truog of Wisconsin University. This test must be used strictly according to directions. Full description can be obtained by sending 10 cents to the Wisconsin Agricultural Experiment Station for Bulletin 312.



## **Neutral Soil**

Some soils are neither sour nor sweet. They are called "neutral" soils. They have just enough lime in them to balance up the acids.

Neutral soils produce some crops very well, but they grow clover and other legumes much better after they are limed.

Ninety times out of 100 neutral soils will produce all crops better after they are limed.

After all, the sure way to tell whether or not our soils need lime is to lime a strip in each field and watch the effect on the crops.

## What Kind of Lime Shall We Use?

Let's ask our County Agent or State Experiment Station.  
There are several forms of lime for sweetening soils.  
Ground limestone is one of the best forms to use on soil.



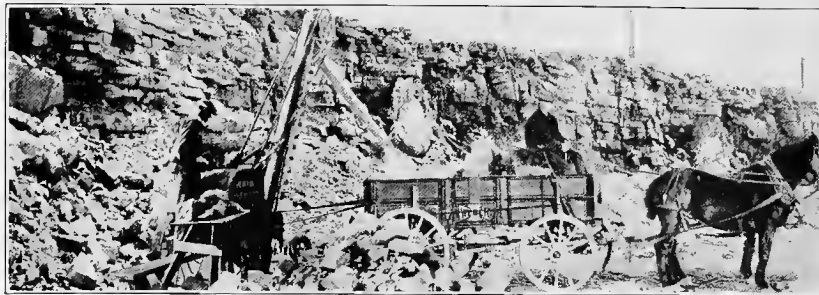
**A ledge of limestone**

Limestone is the greatest source of agricultural lime. It is found in many parts of the country in ledges or stratas of varying thickness.



**A limestone grinding plant in Illinois**

Ground limestone is produced commercially in different parts of the country by being quarried and ground and shipped by carload. Many big plants are equipped with machinery for quarrying and grinding rock in a wholesale way.



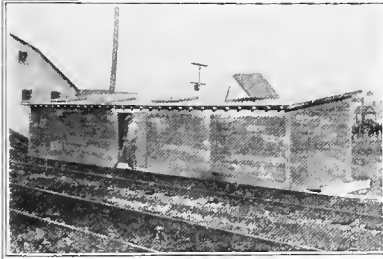
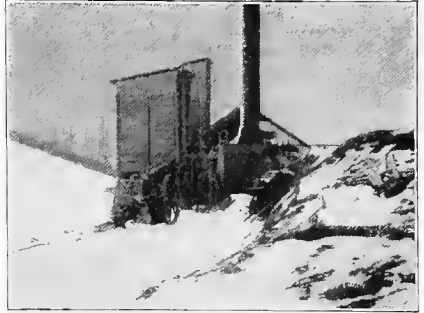
**A portable limestone grinder at work**

Limestone can be ground on our own farm if we have a ledge of limestone. Portable grinders are in use on many farms. Farm Bureaus, and other farmers' organizations can have portable grinders owned and operated co-operatively.

## Ground Limestone

Farm Bureaus or other farmers' organizations or progressive citizens can install in the neighborhood where there is a ledge of limestone, a limestone grinding plant that will be the means of almost doubling the crops for miles around.

Lime grinder and storage bin of 200 tons capacity on the farm of C. A. Smith, Steubenville, Ohio. Mr. Smith says: "I bought 1,000 acres that grew nothing but a few weeds and had been about abandoned. One year ago I began spreading three or four tons of ground limestone to the acre on this land and now have 125 acres of fine clover and 25 acres of alfalfa and will soon have more."



Farm Bureau storage bin in Clearfield County, Pennsylvania, located at railroad switch with convenient doors for loading in and out.



Lime storage and warehouse of Farmers' Co-operative Exchange, Scottsville, Virginia. The lime bin has concrete floors and holds four cars of lime.

## Storage Bins for Limestone

More storage bins are being built each year.

By having the limestone in storage the small farmer as well as the large one can get limestone and he can get it when he wants it. Often the small farmer is unable to get limestone because he is unable to buy it by the carload.

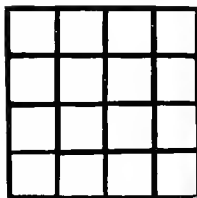
The particular type of storage bin is not important. The main thing is to have a bin and have it located where the limestone can be unloaded into it easily and from it into wagons easily. There should be a scale to weigh the loads hauled away. The cost of a storage bin can be met by a levy of a few cents per ton on the limestone. We are willing to give a few cents extra in order to get limestone when we want it.

Who will build and operate the storage bin depends on the neighborhood. It may be the Farm Bureau, or other farmer organization, the railroad, the bank. Whoever it may be, let's get busy and build the storage bin.

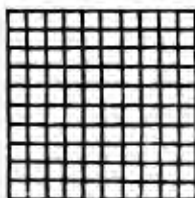
## ***How Fine Should Limestone Be Ground?***

The finer limestone is ground the quicker its action in the soil, but it is not necessary to have it as fine as flour.

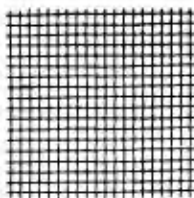
These illustrations show some of the different sizes of mesh in screen used in describing the fineness of ground limestone.



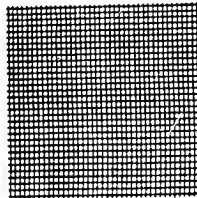
**Quarter-mesh**  
screen means four  
meshes or wires  
to the inch.



**Ten-mesh**  
screen means 10  
meshes or wires  
to the inch.



**Twenty-mesh**  
screen means 20  
meshes or wires  
to the inch.



**Forty-mesh**  
screen means 40  
meshes or wires  
to the inch.

Many experiments have shown that ground limestone, which will pass through a 10-mesh screen, gives excellent results when applied liberally. When it will all pass through a 10-mesh screen, a large per cent of it will pass through a 50-mesh screen. The fine particles will act quickly in the soil and the coarser parts will become available later.

The Illinois Experiment Station found that coarse ground limestone which would pass through a quarter-mesh but not a 10-mesh screen, gave as good results in a few years after being applied as fine-ground limestone did. **Most of us would not want to wait so long for the coarse stone to become available. We would grind it a little finer.**



**Limestone screenings**

Limestone screenings, including the dust and very fine particles will supply lime to the soil. We would need to put on a heavy application on sour soil so as to get enough fine stuff to act at once. The coarse pieces will be a long

time in becoming available. Limestone screenings, or very coarse ground limestone should be purchased at a very reasonable price, and we should not have to haul them far. If we can't get the coarse material cheap and handy we had better use the finer ground stone.

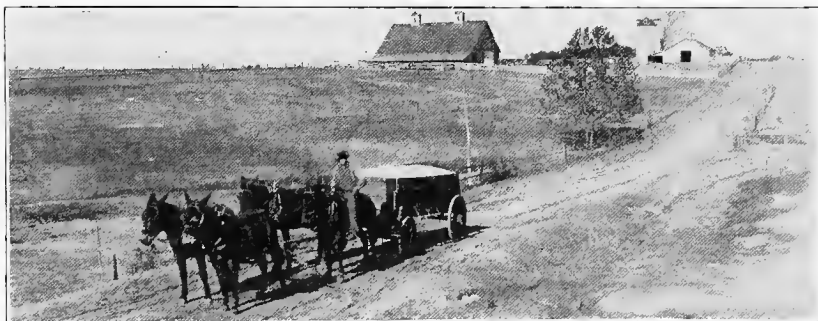
Read next page.

## ***How Much Ground Limestone to the Acre?***

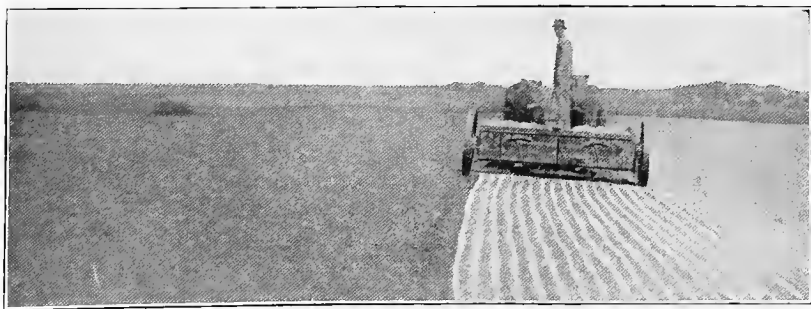
The amount we put on depends on how sour the soil is and how fine the rock is ground.



On a field as sour as this one, that has been farmed until clover won't grow, we would put on at least two tons to the acre of ground limestone that would pass through a 10-mesh screen. We might put on more if the price were attractive and the haul short, or if we were grinding it ourselves.



If we had to haul the limestone six or eight miles over the hills, or if the roads were muddy or rough, we likely wouldn't put on so much to the acre as when it was handy, and we would want the limestone ground fine so it would take immediate effect.



There is one thing about ground limestone—we can put on very heavy applications and do no harm to the soil.

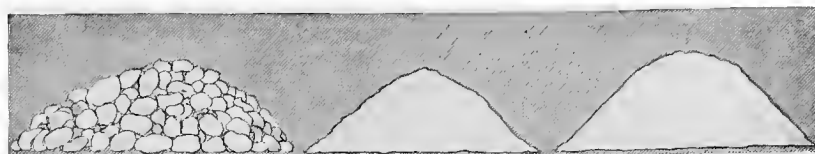
Ask the County Agent or Experiment Station how much to use.

## Quick Lime and Hydrate Lime

Quick lime is also called caustic lime.

Both quick lime and hydrate lime are produced by burning or heating limestone.

Here's the way they are made:



**ONE-TON LIMESTONE**

**1120 LBS. QUICK LIME**

**1480 LBS. HYDRATE LIME**

Here's one ton of raw limestone fresh from the quarry. If we grind it, it's "ground limestone."

We heat or burn the ton of limestone which drives out the carbon, leaving 1120 pounds of quick lime.

We steam or water the quick lime until it weighs about 1480 pounds. It's then hydrate lime.

One kind will furnish lime for the soil as well as the other. Only it takes a little more hydrate lime than it does quick lime to furnish the same amount of lime to the soil, and it takes about twice as much ground limestone as it does of quick lime.

**Caustic lime** cannot be stored satisfactorily for any length of time as it will slack and is apt to burst containers.

**Hydrate lime** can be stored satisfactorily. It should be kept dry.

Quick lime and hydrate lime are prepared commercially in big kilns and hydrating plants. After burning, the caustic lime is usually ground and sacked for shipment. Caustic lime is sometimes shipped as "lump lime" in barrels.

The opinion that caustic lime is injurious to soil has been much overworked. Any bad effects that might result from a reasonable application of caustic lime are more than offset by the good resulting.

### *How Much to the Acre?*

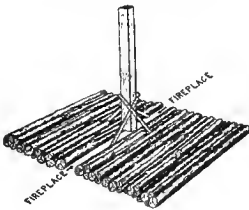
From one to two tons of quick or hydrate lime to the acre will be enough to put on most any soil. Good results have followed the using of much smaller amounts, but we must put it on oftener when small amounts are used. (See page 43.)

## Home Made Lime Kiln

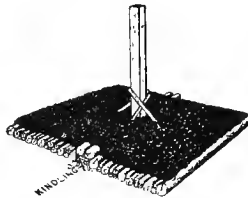
Quick lime can be produced on any farm where there is a supply of limestone, and wood or coal plentiful for fuel.

Here's the way an old fashioned lime kiln is made.

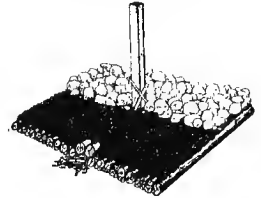
Wood can be used instead of coal.



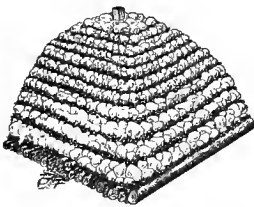
1. Make foundation of logs or scrap timber. Fill in between logs with kindling. Leave narrow opening through foundation for "fire place." Set up board flue in center. Fill the "fire place" loosely with fine kindling.



2. On this foundation place a six-inch layer of fine coal, slack or wood kindling. Put plenty of dry, fine kindling around lower end of flue. A foundation 15 by 20 feet should burn about 400 bushels of lime.



3. Then put on a layer of about one foot of limestone. Spread over the stone enough coal to cover it so the entire surface appears black. It takes almost one-half as much coal as stone. Don't have the stone too large.



4. Put on alternate layers of coal and stone until the kiln is topped out. A little less coal can be used between the upper layers of stone.



5. Bank or smooth the outside of the kiln with coal, then cover the entire kiln above the foundation with three or four inches of earth.



6. Set fire to the kindling in the fire place and add fuel until the kiln is thoroughly afire. It will take from one to two weeks to burn.

When the kiln is burned we have a mixture of quick lime and ashes valuable to furnish lime for soil.

It may be necessary to patch the layer of earth on the outside of the kiln, as it burns and holes break through.

Sometimes the flue in the center is closed, when the kiln is thoroughly afire, to keep it from burning too rapidly.

Home-made kilns are sometimes built by digging into a hill and walling up the kiln with brick or sandstone.

## Marl



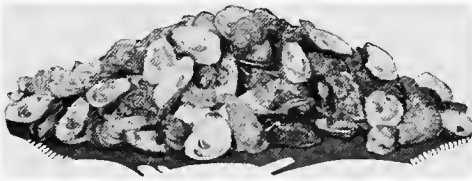
Courtesy Michigan Agricultural College.

### A Michigan marl bed

Marl is a form of soft limestone that has settled in low places and in the beds of streams. It is found in various forms. It may be almost powder or in lumps mixed with small rocks and shells. When wet it often looks like blue clay. Don't mistake blue clay for marl. Try it with muriatic acid. (See page 29.) Marl mixed with shells and stones should be ground before spreading on the soil. Sometimes all that is necessary is to mash up the lumps with the back of a shovel.

The value of dry marl depends on the amount of lime in it. Usually we should apply more marl to the acre than we do of ground limestone.

### Shells



Oyster shells

Shells, such as oyster shells, contain about the same amount of lime as limestone and when ground or burned furnish a good form of lime for the soil.

When ground or burned shells should be used at about the same rate as ground or burned limestone.

### Chalk



Common school chalk

There are beds of chalk in some parts of the country, and chalk is almost pure carbonate of lime, very similar to marl. Usually chalk and marl can be considered as the same thing.

## Marble

Marble, the same material of which old time gravestones were made.

Marble is of the same composition as common limestone and when ground is about the same as ground limestone. Marble dust, scraps and waste from marble works are available in some places for use on the soil and can be used as ground limestone.



## Waste Lime

There are several sources of lime, such as the by-product of beet sugar factories, tanneries, gas works and paper mills. Often this waste lime is wet, heavy to handle, and hard to spread. When it can be procured and spread cheaply and the haul is short, it should be used on the soil. If there is a supply near ask the County Agent or Experiment Station about its use.



Waste lime from a beet sugar factory

## Wood Ashes

Unleached wood ashes have about 5 per cent of potash and 50 per cent of lime. Leached wood ashes have about 20 per cent lime and very little potash. Wood ashes also contain a small per cent of phosphorous. Two tons of wood ashes equal about one ton of lime. Two tons of wood ashes equal about 400 pounds of muriate of potash and 300 pounds of acid phosphate. Wood ashes are valuable for the garden. (See page 22.)

## Gypsum

Gypsum, or land plaster, is sometimes said to furnish lime for plants.

### Basic Slag, Known Also as Thomas Slag

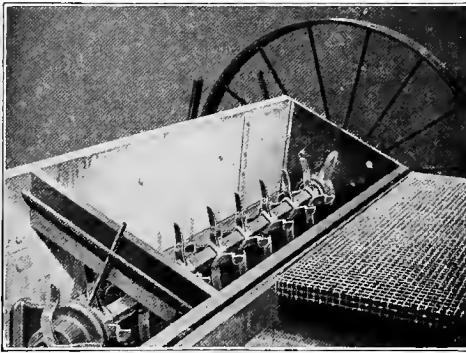
Thomas slag is a by-product of the manufacture of iron. Its principal value is to furnish phosphorous although it contains considerable lime.

When we want lime for our soils we can usually get it at the least expense by using limestone, lime, marl or shells.

## How Shall We Spread the Lime?



The best way to spread lime is with a regular lime spreader that spreads evenly and accurately



A lime spreader should be built of material that will last and so constructed that there will be no chance to clog or feed unevenly.



We want to do a good job of lime spreading and to know just how much we are putting on, as we do in spreading manure or fertilizer. This calls for a reliable spreader.

## How Shall We Spread the Lime?

Some people put quick lime in small piles in the field and allow it to slake before spreading. The piles are placed about 25 feet apart each way, 100 pounds in a pile. This makes about two tons per acre. After the piles have slaked they are spread with a shovel. This is a slow, uneven way. Better use a regular spreader and save man power and time.



Lime can be spread from a wagon with shovels but here's what may happen: The wind may take a turn and we will get lime worked into our skins and eyes. Lime will spoil the harness and make the horses dirty and miserable.



Spreading lime or limestone with a shovel is, of course, one way to do it but there is only one way that is slower or less satisfactory.



Here is the last degree in punishing work. Spreading lime by hand out on a level field. It can be done but a man who likes to do it surely hates himself.



We may have a garden or small, steep patch where a lime spreader can't be used. We may have a pasture too steep, stony or stumpy in which to use a spreader. In these places we must spread by hand or shovel—it's not pleasant work, but it's worth doing.

## How Shall We Spread the Lime?

When we buy lime it must be unloaded from the car when the car arrives. It is not always possible to spread lime the day it is hauled to the farm.



All piled on one side of the field

We can pile ground limestone where we can get to it to spread it later. If possible the limestone should be piled where it can be loaded right into the spreader.

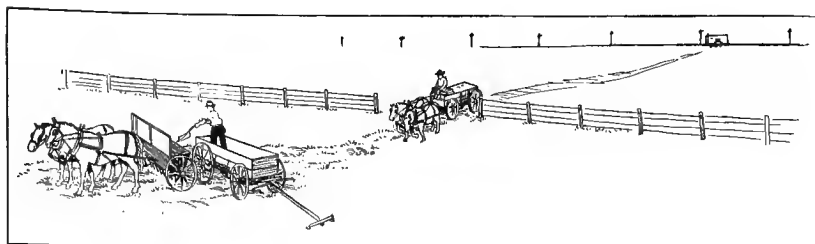


It will often pay when hauling limestone to hitch on an extra team if necessary and haul part of the limestone toward the middle of the field so the spreader can be filled without driving back empty. Remember it has to be hauled to the middle of the field anyway, and it may be done more easily and cheaply, and at a saving of time while it is on the wagon.

A storage bin in the neighborhood where we can get limestone any day, does away with the rush and worry of unloading a car **on time** and sometimes in the rain.

## ***Spreading Limestone Without Losing Time***

Headwork will save a lot of time and make the work easier.



If we have a car of limestone to unload and spread, and the car is only a short distance from the field, we can save time by using three wagons and two teams. One man stays at the car loading the wagons. One man and team haul the loaded wagons from the car to the field and the other man and team keep the lime spreader going in the field. A load is hauled to the field, unhitched from and left to be spread while the team takes the empty wagon back to the car to be loaded. If we have three teams, the man at the car, when he gets a wagon loaded, can drive to meet the team coming with the empty wagon.

This plan won't work if the field is too wet to spread the limestone when it is unloaded. If the haul is a long one the plan would require more men, more teams and more wagons. It would present difficulties and might result in the man at the car having nothing to do much of the time.

A limestone storage bin in the neighborhood would take the uncertainty out of spreading limestone as it is hauled. We could do the hauling when it was suitable to spread.

Whether we haul the lime from a car or storage bin, or grind or burn it on our own farm, let's handle it as few times as possible.

If we haul the lime from town and can't arrange to do a hurry job of keeping the loading and hauling and spreading all going at once, we should arrange if possible to haul the lime when we can haul a load of something to town each time we go for a load of lime. We lose a lot of time driving to and from town with an empty wagon.

## When is the Right Time to Spread Lime?

When our soil needs lime the main thing is to put lime on it. It is better to put lime on any time of the year than to not put it on at all.

There is always a best time to apply lime. The best time for us depends on conditions.

Ground limestone, ground shells or marl can be applied almost any time of the year with good results.

Caustic or hydrate lime may be better spread in the spring just before a crop is planted, especially in the South where there is danger of the lime's leaching away through the winter season.

Put lime on top.



When putting lime on cultivated fields it is better to spread on the plowed ground and work it into the top soil as the field is prepared for planting.



Ground limestone can be spread on growing crops, such as wheat, clover or alfalfa, with no damage to the crop, if spread when the crop is small and the ground solid; it is better to put it on before the crop is planted.

Caustic lime may do some damage to young plants if a heavy application is put directly on the plants.

Better not spread lime on a slope in the winter time, it may wash off.



We will have to figure out for ourselves the best time to put lime on our fields. We must consider the most convenient time, the time that can be spared from other important work, and when the roads are best for hauling.

## How Often Should We Put Lime on Our Soil?

It depends on how much we put on, how sour the soil is, the kind of crops and how much it rains.

**A ton of caustic or hydrate lime** (see page 34) to the acre will usually furnish enough lime for three or four years on most soils.

**Two tons of finely ground limestone** will do about the same work in the soil as one ton of caustic lime.

Many good farmers put on three or four tons of **ground limestone** to the acre at one application, claiming that it doesn't take much more work after the limestone is hauled to the field to put on four tons to the acre than it does two tons, and the application will last longer.

It is the practice in some sections, particularly in the eastern states, to put on light applications of **caustic lime or hydrate lime** and put it on oftener. Some good farmers put on from 300 to 600 pounds of caustic lime for each crop in the rotation. This furnishes about enough lime for each crop, so there won't be much extra lime to leach away.

The distance we must haul the lime and the kind of roads have a lot to do with the kind and amount of lime we use.



If we have to haul lime over the hills or through mud it may be best to use quick lime and a light application to the acre to get our fields started, then we can use more the next time.

Let's ask our County Agent or our Experiment Station how much lime we should put on, and how often. They know our local conditions.

## **When Our Soils Need Lime the Main Thing Is to Put Lime on Them**

We may not all agree with the statements in this book. That's not so important if only we find something useful in it. Most of us are looking for the useful things.

Lime won't cure all our soil troubles, it's only a big help. Lime won't put any other plant food into the soil, but it will help the plants to get what is already there.

Most soils contain a good deal of plant food, but it often doesn't get in shape fast enough for plants to use it on account of the slow action of the soil bacteria. Put on lime and the bacteria go to work. Along with the lime we must use legumes and manure and supply other plant food when it is needed. Lime is only part of the program but it's a mighty important part when it is needed.

### ***The Kind of Lime***

If it is the plan in our neighborhood to use ground limestone and we can get it easily, let's use it. If it's a long haul and bad roads, we might better use caustic or hydrate lime. If we have shells or marl near, let's use that.

### ***Let's not put off liming.***

If our soil needs lime let's get lime on it. There's a way to do it. We make a mistake putting off liming until we are "able." The sooner we put on the lime the sooner we will be "able"; the sooner we will be growing good crops. The man who puts off liming when his soil needs it, is wasting a share of his life.

After we put lime on our soils, we'd be foolish if we didn't grow legumes and have the bacteria working for us.

We are foolish when we buy and sow high-priced clover or alfalfa seed on a soil that needs lime. That's what a lot of us are doing.

Markets are surely important—we must have the best possible market. Then, as always, the individual farmer cannot prosper without big yields per acre. It may be good business to cut down the acreage but not the yield per acre. We can't name a man who went broke producing big yields to the acre. We can name several hundred men who went broke producing small yields per acre. Lime in the soil is necessary for big yields per acre.

## **It Costs More to Do Without Lime Than to Use It**

Maybe we'll say, "Lime costs too much." There may be reasons for feeling that way.

Producing and shipping lime, like running a farm, costs money. Perhaps if we were in the business of producing or handling lime we'd do it about as it is done. We want to get our lime as economically as we can. It costs a lot more to do without lime when it is needed than it does to use it.

Before we say, "We'd use more lime if we could get it when we want it," remember there's usually a way to get what we need. We have neighbors. Can't we get together, provide storage and keep a supply on hand? Other folks have done this. Maybe we can produce the lime right in our own neighborhood.

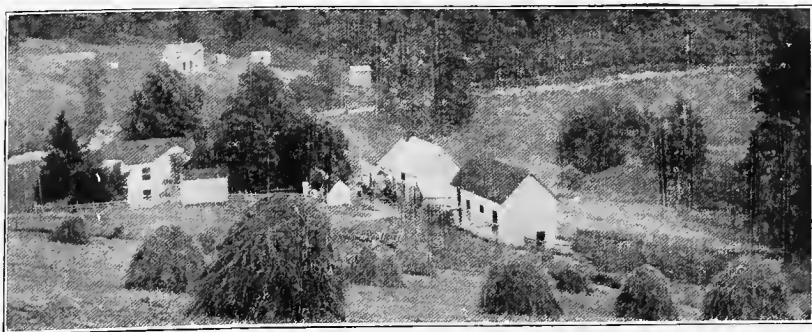
The banker, dealer, manufacturer, railroader, and every other town business man is interested in the use of lime on our soils.



**The prosperity of the town depends on the country.**

There's no one thing that will contribute more to the prosperity and happiness of everybody than to get lime on the soil when the soil needs it.

Business men know that towns prosper in proportion as they contribute to the farmers' prosperity. Before we object to that statement let's do a little meditating.



Lime has changed many a poor, hilly farm to a regular country factory turning out big crops, contributing to the welfare of everybody in the neighborhood.

Anything we can do to help get lime on our sour soils promptly and economically is one of the best strokes of business for everybody.

# The IHC Agricultural Extension Department

## What It Is — What It Does

**W**HAT is the Agricultural Extension Department of the International Harvester Company?

It is not a sales department. It is not an advertising department. It is a department to help every community to be more prosperous and happy.

The Harvester Company is a citizen of every neighborhood and through its extension department offers to help folks who want to help themselves. Every community must work out its own problems but the department will do all it can to help in any movement that means a better community.

How is this done? Through seven divisions of the department.

1. **Short Course and Campaign Division** furnishes practical lecturers and demonstrators to help communities with short courses and campaigns on farming and home making. Ask the nearest IHC Branch House about this service.

2. **Lecture Division** furnishes lecturers and demonstrators for special meetings when possible. There is no charge except traveling and hotel expenses of the lecturer.

3. **Chart, Slide and Reel Division** has 2,000 large lecture charts and 1,000 sets of lantern slides and motion picture reels on farm, home and community problems which are loaned to county agents, community clubs, schools, colleges, lecturers, teachers or anyone making good use of them. They are loaned free, those who borrow them paying transportation charges to and from Chicago or nearest supply point.

4. **Publicity Division** prepares booklets like this one (about 100 different booklets on list); prepares special educational articles which are furnished free to newspapers, farm journals and other publications; furnishes cuts and photographs to newspapers, farm bureaus and others.

5. **Literature Division** distributes the booklets. A small charge to cover the actual cost is made for the books. Merchants, bankers, business men — all public spirited citizens who wish to co-operate in getting these books in the hands of those who will be most benefited by them can have their compliments or message to their local people printed on the back cover without additional charge.

6. **Library Division** has complete library of agricultural information including state, government and experiment station bulletins, for the purpose of answering inquiries and furnishing information. No charge is made for this service.

7. **Art Division** makes lecture charts for our own use, for county agents, farmers organizations, commercial clubs or individuals who want to do something for their communities.

# The Visual Method of Instruction

## The Big Idea in Education Characterized in IHC Lecture Charts and Lantern Slides SIMPLE—LOGICAL—IMPRESSIVE—PRACTICAL

**USED EVERYWHERE**—In Community and Home—  
Rural School and College—On the Farm and In the Factory  
—By Teacher, Pupil, Farmer, Banker and Merchant

## IHC CHARTS OR SLIDES LOANED FREE

On these conditions—that you have a plan for using them, pay express charges from Chicago and return, and report all meetings at the end of each week

### CHARTS OR SLIDES FURNISHED ON THE FOLLOWING SUBJECTS:

- |                                              |                                          |
|----------------------------------------------|------------------------------------------|
| 1. Corn is King                              | 8. Weeds Mean Waste.                     |
| 2. Alfalfa on Every Farm.                    | 9. Home Economics and Sanitation.        |
| 3. A Fertile Soil Means a Prosperous People. | 10. Fight the Fly.                       |
| 4. Live Stock on Every Farm.                 | 11. Great Forward Movement in Education. |
| 5. Dairying.                                 | 12. Diversified Farming for the South.   |
| 6. Greater Profit from the Oat Crop.         | 13. Home Canning.                        |
| 7. Make More from Your Farm Poultry.         | 14. Development of Agriculture—          |

(No. 14 in Lantern Slides only.)

### CHARTS

IHC lecture charts are 70 inches long by 63 inches wide, made of a good grade of sheeting, printed in clear black letters, which can easily be read at a distance of 100 feet or more. They are arranged for setting up and taking down quickly and conveniently.

Sets contain from ten to fifteen charts. Each set with iron stand, pointer, and lecture book, is packed in a canvas case. Weight, 35 lbs.

### LANTERN SLIDES

Lantern slide sets, 50 to 60 slides, plain and in colors. Weight, 15 lbs.

### Lecture Books Furnished

For the information and direction of lecturers, each set contains an illustrated lecture book outlining in brief form the story of each chart or slide.



**T**HE sole object of the Agricultural Extension Department of the International Harvester Company is to help YCU make YOUR work more effective. It is not a matter of making money out of charts, slides, booklets, or any other material prepared and published by the Department. The Extension Department was not organized to make sales. But we do want to work with people who are in earnest; who really want to do something worth while.

Circuits formed to reduce express charges. Write for plan.

FOR FURTHER INFORMATION ADDRESS

**INTERNATIONAL HARVESTER COMPANY**

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